Project PARETO – DOE’s Produced Water Optimization Initiative

Narendra Susarla1,2, Elmir Shamlou1,2, Travis Arnold1,2, Philip Tomina1,2, Miguel Zamarrilla1,2, Markus Drouven1,2

Project Premise and Goals

Develop a decision-support tool to transport, treat, store, inject and/or reuse produced water from onshore oil & gas operations.

PARETO software helps with:

- Infrastructure buildout
- Produced water management
- Treatment technology selection
- Facilities placement and sizing
- Assessing water reuse options
- Distribution for reuse

- Views produced water from a “systems” perspective.
- Is intended to serve as a resource to the community.

PARETO was designed to become a trusted decision-support tool for the produced water community.

Motivation and Challenges

- Produced water volumes are increasing.
- Disposal capacity is rapidly decreasing (seismicity).
- Produced water is challenging to treat:
  - High TDS concentrations (up to 200,000 mg/L TDS).
  - Variety in production quantities and qualities.

Rigorous optimization models will help the industry find new ways of dealing with produced water.

Project Development

- Open-source framework and user-interface development.
- https://github.com/project-pareto
- https://github.com/project-pareto-project-pareto
- Capabilities to solve existing real-world challenges.
- Beneficial reuse, seismic restrictions.
- Industrial collaborations and applications.
- Evaluating through the lens of potential users.

Team PARETO actively engages with its stakeholders to identify important challenges and develop solutions.

Needa for Beneficial Reuse

- Disposal Challenges:
  - High transportation costs.
  - Induced seismic activity.
  - Storage challenges:
    - Restricted storage capacity.
    - Leakage risk.
  - Stress on freshwater resources.

- Treatment disposal:
  - Desalination to remove dissolved solids.
  - Treating Produced Water for Recycling and Reuse.

PARETO Beneficial Reuse Framework

- Infrastructure buildout
- Produced water management
- Treatment technology node
- Facilities placement and sizing
- Assessing water reuse options
- Distribution for reuse

You have accepted the match
Consumer
You have accepted the match
Producer
You have accepted the match

Industrial case studies are critical to demonstrate PARETO’s usefulness, relevance, and importance to practitioners.

Mid-stream Case Study Example: ARIS Water

- Network configuration
- Forecasts (production, flowback)
- Capacities and costs
- Planning horizon (18 months)

Determining

- Infrastructure (capital decisions)
- Optimal flows and directions
- Capacity utilization
- Optimal job (flowback) selection

PARETO takes < 30 seconds to solve the problem, allowing the operators to perform several “what-if” scenario analyses.

In-depth Analysis and Insightful Results

- Optimization setup
- Sensitivity to choose from:
  - CSP1, CSP2
  - PARETO-H, PARETO-M
- Consider revenue and costs of maintaining profitable

Qualitative Results:

- PARETO-Choose CSP1 and CSP4
- CSP3 is a similar solution
- Requires further pipeline buildout

PARETO Industrial Collaborations

The team continues to collaborate with several industrial partners:

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Water Sharing: Motivation

- Produced water management and reuse:
  - Fresh water injection should be avoided.
  - Produced water can be used for injection.
  - Storing produced water is a cost.
  - Operators will—and do—share water assets on an ad-hoc basis.

Key Points:

- Operators have an ad-hoc peer-to-peer produced water resource sharing system.
- Can we help them along and improve water reuse?

PARETO Extensions/Spin-offs

Process Illustration: Simple Water Sharing

How will users interact with the Water Sharing Portal?

- Assume all users must be registered
- Distinction between “producers” and “consumers”

The portal is similar to a matchmaking application for produced water.

Results: Water Sharing Reduces Driving Distances and Waste

- Higher percentage of disposal due to lack of internal need for produced water
- 100% reuse of produced volume possible

Sharing water resources gives operators more opportunities to reuse water.